

parts to be examined, and thereby suddenly destroying vitality and coagulating the proper juices, renders the existence of *vasa propria* in certain parts clearly demonstrable.

XLIV.—On *Acantholeberis* (Lilljeborg), a Genus of *Entomostraca* new to Great Britain. By the Rev. ALFRED MERLE NORMAN, M.A.

[Plate XI.]

Fam. Daphniidæ.

Genus ACANTHOLEBERIS (Lilljeborg).

(Syn. *Acanthocercus*, Schödler.)

Anterior antennæ large and conspicuous, porrected from the front of the head. The upper branch of the posterior antennæ four-jointed, and bearing at its termination three plumose setæ and a spine: lower branch three-jointed, and having the first joint provided with a remarkably long-spined seta, the second also furnished with one very long seta, and the last joint terminating in three setæ and a spine. The postero-ventral angle of the carapace is fringed with very long setæ of a spine-like character. Feet five pairs. Intestinal canal simple and straight at first, but furnished with a loop near the anus.

The genus *Acanthocercus* was founded by Schödler, in the 'Archiv für Naturgeschichte' for 1846, for the reception of a remarkable Entomostracan which Müller had described in the 'Zoologia Danica,' under the name of *Daphne curvirostris*. Fitzinger had, however, established a genus of reptiles under the same name three years previously; and Lilljeborg, therefore, in his work on the Entomostraca (*De Crustaceis ex ordinibus tribus Cladocera, Ostracoda, et Copepoda in Scania occurrentibus*) changed the name of the genus to *Acantholeberis*.

In general characters *Acantholeberis* is closely—perhaps almost too closely—allied to *Macrothrix* (Baird). The resemblance is seen in the general form of the carapace and of the organs of the body, but especially in the large size and position of the anterior antennæ, and in the peculiar and exceptional structure of the long seta of the first joint of the lower branch of the posterior antennæ. The chief differences are to be found in the number of setæ on the upper branch of the posterior antennæ, which in *Macrothrix* are four, but in *Acantholeberis* only three; and in the fact that there is a loop in the intestinal canal of *Acantholeberis* towards the posterior extremity below the point of attachment of the fifth feet; while in *Macrothrix* there is no such fold, the course of the canal being straight.

In 1858, Lievin described a second species of the genus; but
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his *A. sordida* shows such marked points of divergence from the type as to make us doubt whether the genus has been founded on sufficiently good grounds, and whether it should not rather be united with *Lathonura*, Lilljeborg (= *Pasithea*, Koch), and *Macrothrix*. *A. curvirostris* and *A. sordida* are the only known members of the genus, and both these species have now been found in Great Britain.

Acantholeberis curvirostris (Müller). Pl. XI. figs. 1-5.

Daphne curvirostris, O. F. Müller, Zool. Dan. p. 200. No. 2403.

Daphnia curvirostris, O. F. Müller, Entomostraca, p. 93, pl. 13. f. 1 & 2.

Acanthocercus rigidus, Schödler, Archiv für Naturgeschichte, 1846, B. i.

p. 301, pl. 11 & 12. Lievin, "Die Branchiopoden der Danziger Gegend,"

Neueste Schriften der Naturforschenden Gesellschaft in Danzig, B. iv.

p. 33, pl. 8. f. 1-5. Leydig, Naturgeschichte der Daphniden, p. 195.

Acantholeberis curvirostris, Lilljeborg, De Crust. ex ord. Clad. Ostrac. et Copep. p. 52, pl. 4. f. 3-7, & pl. 23. f. 10, 11.

The carapace is somewhat oblong in form, rather truncate below, and with the hind margin nearly straight, since the matrix is but little protuberant in the gravid female. The head does not lean forward, as is usually the case among the Daphniidæ, but is remarkably upright. To the upper point of the beak the anterior antennæ (Pl. XI. fig. 2) are attached, and from it they are projected at nearly a right angle. These organs are very large, and strap-shaped; they are slightly serrate on the upper margin, and gradually widen towards the extremity, which is furnished with six or eight cylindrical tentaculiform filaments. The supplemental eye-spot is situated close behind their bases, and is very small.

The posterior antennæ are long and slender; their peduncles are not very muscular, are corrugated on the basal half, and bear a few minute spines on the surface towards the distal extremity. The upper and four-jointed branch of these antennæ has the first articulation very small, the second considerably longer, and furnished with a spine on the upper margin, but no seta; the third is unprovided with appendages; the fourth terminates in three two-jointed plumose setæ and a spine, which does not equal one-third of the basal portion of the setæ in length. The first joint of the lower branch bears an unusually long two-jointed seta of remarkable character, and which, indeed, forms one of the chief features in this interesting Entomostracan. The basal portion of this seta is provided with short cilia on the outer or upper margin, while the inner margin is smooth; the second portion of the seta (Pl. XI. fig. 3) has a series of rather distant spines upon the outer margin; and between these spines a high power of the microscope shows a fringe of short, closely-set cilia.

The second joint of the lower branch of the posterior antennæ bears another seta of great length, which differs, however, in its armature from that of the first joint. This seta is plumose on both margins throughout its entire length; and between the longer hairs of the outer margin of the distal portion are short closely-set cilia (fig. 4), similar in character to those between the spines of the seta which is attached to the first joint. The third joint ends in three two-jointed plumose cilia and a spine.

The labrum has a large and conspicuous, much elevated, acutely papilliform process in front. The terminal portion of the abdomen is bordered with a closely-set array of spines, and has the sides, moreover, thickly studded with an admixture of slender spines and hairs. The abdominal setæ are long, while the terminal claws (fig. 5) are rather short, a little flattened, and minutely pectinated along the edges. The ventral margin of the carapace is fringed throughout its entire length with plumose setæ; and these setæ attain an extraordinary length at the angle formed by the junction of the ventral and posterior margins.

Acantholeberis curvirostris was discovered last summer by Mr. D. Robertson, in the Isle of Cumbrae in the Firth of Clyde, living in some abundance in a small shallow pond about 12 feet square, which had been cut out of the sandstone rock, and was covered at the bottom with moss and *Confervæ*. Mr. Robertson informs us that though the species seems fond of remaining quietly among the weeds, it nevertheless is tolerably active when swimming, which it effects with a slight jerking motion, often in curves. It has a habit of mounting to the surface of the water, and then allowing itself passively and slowly to sink to the bottom, with its antennæ spread out on either side. It rarely resumes active motion when in its downward course, unless it is disturbed.

A second locality for the species is Crag Lake, Northumberland, where it has been met with, during the present spring, by Mr. G. S. Brady.

Acantholeberis sordida (Lievin). Pl. XI. figs. 6-9.

Acanthocercus sordidus, Lievin, "Die Branch. der Danziger Gegend,"
Neueste Schriften der naturf. Gesells. in Danzig, B. iv. p. 34, pl. 8.
f. 7-12. Fischer, Bull. de la Soc. Imp. des Nat. de Moscou, 1854.
Leydig, Naturgeschichte der Daphniden, p. 199.

Carapace nearly round, widest below, and slightly truncate on the inferior margin, tumid, and having the surface clothed with short hair. Anterior antennæ largely developed, long, cylindrical. Posterior antennæ short and stout; their peduncles

very large, stout, and powerfully muscular. Both branches very short, the separate articulations being scarcely longer than they are broad, and the total length of the branches barely exceeding the width of the bases of the enormously developed peduncles. Upper and four-jointed branch terminating in three plumose setæ and a long spine, which equals two-thirds the length of the basal portion of the setæ. Lower and three-jointed branch having a seta at the extremity of the first and second joints, and three setæ and a spine at the termination of the third joint. The setæ of the first two joints do not differ materially in character from those at the extremity. The last portion of the abdomen (Pl. XI. fig. 7) is in the form of a somewhat flattened semicircular plate, margined with large spines. The claws are large, produced, simple, and cylindrical. Just below their base is a cluster of small spines, which are succeeded by some still smaller spines; behind these the spines increase in size, becoming both numerous and large. The abdominal setæ are long and slightly plumose. The ventral edge of the carapace is fringed with plumose setæ (fig. 8); but at the posteroventral angle these setæ become much longer, assume quite a spine-like character, and bear, as it were, smaller spines attached to one side (fig. 9). The entire animal is of a brilliant crimson colour.

This Daphnian is remarkable alike in history and in habits. On examining with a hand-lens the vegetable matter in a bottle of water brought home from a clear pond which had been cut out of the limestone rock, to contain water for the supply of the engine at a now unworked colliery at Bishop Middleham, in the county of Durham, a small blood-red Entomostracan, which was lying upon its back in the water, attracted attention; and on further search, two more individuals were found in the same bottle. They at once became a source of great interest; for *A. sordida* is the most helpless animal possible. It is totally unable either to swim or to walk. The setæ of the antennæ are apparently of insufficient length to confer the power of swimming; and the feet in this family, though valuable agents in respiration, are totally unfitted in their structure for purposes of locomotion, and, indeed, being contained within the carapace, could not by any possibility be used for the support of the body. The animal therefore lies upon its back, kicking and struggling, swinging to and fro its brawny arms (the posterior antennæ), and thrusting in and out of the carapace-valves its largely developed and strongly spined abdomen in the vain attempt [to push itself from place to place; but the efforts, though most vigorous, are of little avail, and its progress is extremely slow. It is probably in consequence of these sluggish

habits, and of the animal rolling itself in the mud, as well as owing to the pilose covering of the shell, that it owes the coating of mud, Diatoms, and Desmids which render it so difficult a matter to see the structure of the organs of the body contained within the carapace. That the coating of extraneous matter is the effect, and not the cause, of the inability of the animal to swim is proved by the fact that one of the specimens obtained, which was sent to Mr. G. S. Brady for the purpose of obtaining his kindly extended and valuable aid in the delineation of the species, gave birth to five young while in his possession; and he informed us that, though these young, when first born, were able to raise themselves slightly in the water, yet it was not more than about half an inch, nor could this be effected without great effort, or, apparently, without the assistance of the sides of the vessel in which they were contained; and when two or three days old, even this limited power of locomotion was lost. Mr. Brady wrote to us the following vivid description of the motions of these young specimens:—"It is a sight to see the brutes swim, or *try* to swim, under the microscope. When a good view from the dorsal aspect is obtained, one sees that they put their two great antennæ together, and strike out in a good bold sweep like any Christian, the superior antennæ working synchronously, but in a smaller arc, inside the greater ones. The motion of these lesser antennæ is very beautiful; and the muscular contractions in the basal joints of the greater ones are remarkably plain, throwing the limb into great wrinkles. When the animal is tired of this sort of exertion, it stops its arms, and begins working its branchial apparatus at a great rate; but, so far as I can see, the two systems are never in active motion together. They seem to attract dust and parasitic growths; for, though kept in simple water, they are surrounded with confervoid filaments, Diatoms, Oscillatoria, &c."

Another remarkable feature in the history of this Daphnian is the great scarcity of the species individually. As a rule, where an Entomostracan occurs at all, it is to be met with in abundance. This is very far from being the case with *A. sordida*. Failing in the attempt to make out the structure of the three specimens we had obtained in the Bishop-Middleham colliery pond, and being unwilling to destroy them by attempted dissection, we hoped to render the dense character of the carapace-valves more transparent by mounting them in Dean's medium. The result was far from satisfactory. The pond was therefore revisited in the hope of again finding the species, and this not once, but many times; but, though the greatest trouble and care were taken, no further specimens could be met with. Subsequently, however, a single example was obtained under pre-

cisely similar circumstances to those under which the former had been taken, among material collected in the Forge Dam at Sedgfield, a spot about two and a half miles distant from the first locality. It is from this example that the figures and description of this paper have principally been derived. All after-attempts (and they were not a few) to take this species in the Forge Dam were as unavailing as they had proved in the case of the colliery pond.

We had at first thought that this abnormal species might be new to science; and when we found the description of this animal in Leydig's work, we could not help being amused at the remarkable parallelism between our own experience and that of Fischer and Leydig; and we really are afraid that it was some consolation, after the great trouble that had been taken in the vain attempt to obtain additional specimens, that other naturalists had suffered precisely similar disappointments. Fischer says that he could only find a single specimen, and therefore is obliged to content himself with referring to the description of Lievin; and Leydig writes, "I have only once observed *Acanthocercus sordidus*, in a muddy lake at Tübingen. It was a single specimen, which struck me by its blood-red colour, and also by the ample investiture of mud which surrounded the animal. Added to that, it did not swim, but crept slowly along the bottom of the vessel. Circumstances prevented my drawing the animal, and every subsequent trouble I took to find the animal again was in vain."

We have already referred to the fact that this species does not appear to embrace all the characters which are assigned to the genus *Acantholeberis*. It agrees with *A. curvirostris* in the number of setæ attached to the posterior antennæ, and also in the presence of setæ of great length at the posterior ventral angle of the carapace. It differs in the fact that the setæ of the first two joints of the lower branch of the posterior antennæ are short, and do not differ in character from the ordinary plumose setæ of the Daphniidæ. But a more important instance of divergence would appear to exist in the structure of the intestinal canal, which does not seem to possess a loop near the excretory orifice, as in *A. curvirostris*; nevertheless a great dilatation of the canal exists in an analogous position, forming apparently a strong muscular rectum. At the same time, we speak with hesitation on this point, and our opportunities of investigating the structure of the species have not been sufficient to enable us to speak with certainty on this and other points.

Sedgfield, county Durham.

May 18, 1863.

EXPLANATION OF PLATE XI.

- Fig. 1. *Acantholeberis curvirostris* (Müller), ♀.
 Fig. 2. Anterior antenna of the same species.
 Fig. 3. Portion of the terminal half of the seta attached to the first joint of the lower branch of the posterior antennæ; greatly magnified.
 Fig. 4. Portion of the terminal half of the seta attached to the second joint of the lower branch of the posterior antennæ, greatly enlarged.
 Fig. 5. Abdominal claws.
 Fig. 6. *Acantholeberis sordida* (Lievin), ♀.
 Fig. 7. Abdomen of the same species.
 Fig. 8. Setæ from the ventral margin of the carapace.
 Fig. 9. Setæ from the posteroventral angle of the carapace.

XLV.—*On the Form of the Cells made by various Wasps and by the Honey Bee; with an Appendix on the Origin of Species.*

By the Rev. SAMUEL HAUGHTON*, Fellow of Trinity College, Dublin.

THE geometrical form affected by the cells of various kinds of wasps and bees has attracted the attention, and called forth the speculations, of naturalists and geometers from the earliest periods. By one class of writers the geometrical properties of these cells have been used as proofs, not so much of the skill and instinct of the insects as of the wisdom and intelligence of their Creator; while, by the opposite class of writers, these same geometrical properties of the cells are alleged as a sufficient cause for the production of the insects that make them, from the advantages which these forms of cells are supposed to possess over other forms—advantages said to be so important as to decide the battle of life in favour of the insects that adopt the geometrical plan of making their cells.

I have for a long time felt convinced that both parties in this controversy are in error, as men generally are when they attempt to speculate on the reasons for the existence of things; and that the properties of the cells are only the necessary consequence of their geometrical form, which form itself is the necessary consequence of mechanical conditions totally unconnected with design, and incapable of rendering an account of the origin of the insects that make the cells.

The geometrical cell of the wasps and bees that I have had an opportunity of examining may be divided into three classes.

1st. Hexagonal cells formed of adjoining pyramidal figures, with slightly curved axes, not terminating in a point, but in a rounded extremity.

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